ABSTRACT:

The performance of widely tuneable, continuous wave (cw) external-cavity quantum cascade laser (EC-QCL) has been evaluated for direct absorption spectroscopy measurements of nitric oxide (NO) in the wavenumber range 1872-1958 cm-1 and with a 13.5 cm long optical cell. In order to reduce the absorption measurement errors due to the large variations of laser intensity, normalisation with a reference channel was used. Wavelength stability within the scans was analysed using the Allan plot technique for the reduced wavenumber range of 1892.4-1914.5 cm-1. The Allan variances of the NO absorption peak centres and areas were observed to increase with successive scan averaging for all absorption peaks across the wavelength scan, thus revealing short- and long-term drifts of the cw EC-QCL wavelength between successive scans. As an example application, the cw EC-QCL was used for NO measurements in the exhaust of an atmospheric pressure packed-bed plasma reactor applied to the decomposition of dichloromethane in waste gas streams. Etalon noise was reduced by subtracting a reference spectrum recorded when the plasma was off. The NO limit of detection (SNR = 1) was estimated to be ˜2 ppm at atmospheric pressure in a 20.5 cm long optical cell with a double pass and a single 7 s scan over 1892.4-1914.5 cm-1.